

REMARKS

This is in response to the Office Action mailed on June 29, 2001. Claims 1-20 were under consideration in the application, and the Examiner rejected all claims. With this amendment, claims 13, 14 and 16-20 are cancelled and claims 2-12 and 15 are amended. The remaining claim remains unchanged.

On page 2 of the Office Action, the Examiner indicated that FIGS. 1-5 of Applicant's drawings should be designated by a legend such as "Prior Art". With this Amendment, amended FIGS. 1-5 are proposed by Applicant. Each of the amended Figures includes Examiner's suggested legend. The amended drawings with proposed changes marked in red, along with a "Request For Correction To Drawings," have been included with this amendment.

Also on page 2 of the Office Action, the Examiner indicated that Applicant's title is not descriptive. With this Amendment, Applicant's title has been amended. It is respectfully submitted that the amended title is clearly indicative of the invention to which the claims are directed.

Also on page 2 of the Office Action, the Examiner objected to claims 4-5 based on minor typographical errors. With this amendment, Applicant has corrected the errors.

Beginning on page 2 and carrying over to the top of page 3 of the Office Action, the Examiner rejected claims 13-15 and 20 under 35 U.S.C. §112 as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicant regards as the invention. Of these rejected claims, claims 13, 14 and 20 are cancelled with this amendment. Accordingly, only claim 15 remains pending.

The Examiner rejected claim 15, it would seem, for including an ambiguous dependency. With this amendment, claim 15 has been amended to clearly depend on independent claim 2. It is

respectfully submitted that claim 15 now satisfies the requirements of §112.

On page 3 of the Office Action, the Examiner rejected claims 1 and 13-15 under 35 U.S.C. §102(e) as being anticipated by Boutaghou (US 5,796,556). Of the rejected claims, claims 13 and 14 are cancelled with the present amendment. Claims 1 and 15 remain pending.

Claim 1 includes "conducting means for providing electrical connection between the transducer and an external circuit". Since the conducting means is written in "means-plus-function" form, this element covers the corresponding structure, material, or acts described in the specification and equivalents thereof. 35 U.S.C. §112, paragraph 6 (2001). The Federal Circuit has held that paragraph 6 applies to patentability determinations of such language in the Patent and Trademark Office. In re Donaldson Co., 29 U.S.P.Q.2d 1845 (Fed. Cir. 1994). Therefore, a means-plus-function element must be construed by the PTO during examination to cover the corresponding structure, material or acts described in the specification and equivalents thereof. Any broader construction adopted by the PTO would be contrary to U.S. patent law, as interpreted by the Federal Circuit.

In the present application, the corresponding structure to the "conducting means" element is shown in Applicant's specification at least in FIGS. 6 and 7, and in the accompanying sections of the written description. For example, FIGS. 6 and 7 illustrate a flexible circuit 250 having electrical filaments 252 that are generally electrically insulated from each other by a dielectric substrate 254 (page 9, lines 14-24). Page 10, lines 1-3 of Applicant's specification describes substrate 254 as including a liquid crystal polymer. Applicant's specification goes on to describe different illustrative embodiments of Applicant's invention, wherein substrate 254 includes a liquid

crystal polymer that enables substrate 254 to demonstrate particular disclosed characteristics (i.e., particular thicknesses)(page 10, lines 4-6). Applicant's specification also describes incorporation of particular liquid crystal polymers into substrate 254, such as specific types of liquid crystal polymers (i.e., page 10, lines 8-23), or liquid crystal polymers demonstrating particular characteristics (i.e., illustrative coefficients of thermal expansion, coefficients of humidity expansion, dielectric constants, etc.), for example, see Applicant's specification at page 13.

In the cited Boutaghou reference, there is a disc drive incorporating a flexible circuit that does not have equivalent structures as those illustrated and described within the present application. For example, Boutaghou describes incorporation of a traditional polyimide material but makes no mention or suggestion of any liquid crystal polymer materials. Thus, a comparison of Applicant's specification to the teachings of Boutaghou reveals significant inconsistencies. Applicant therefore respectfully requests that the rejection of claim 1 under §102(e) be withdrawn. Allowance of claim 1 is respectfully solicited.

Claim 15 has been significantly amended and now depends on independent claim 2. Applicant respectfully submits that the Examiner's rejection of claim 15 (the rejection in view of Boutaghou) is no longer applicable to claim 15 in view of the change in that claim's dependency, as accomplished by the present amendment. Applicant will discuss claim 15 below in relation to independent claim 2.

On the bottom of page 3 of the Office Action, through the top of page 4, the Examiner rejected claims 1-3, 6, 11-16 and 18-20 under 35 U.S.C. 102(e) as being anticipated by Himes et al (US 6,046,886). Of these rejected claims, claims 13, 14, 16 and 18-20 are cancelled with the present amendment. Claims 1-3, 6, 11, 12 and 15 remain pending.

As is indicated by the priority claim included with this amendment, Applicant wishes to claim priority from the Himes et al. reference. It is respectfully pointed out that the Himes et al. patent and the present application include two common inventors. In addition, it is also pointed out that the Himes et al. reference issued on April 4, 2000, while the present application was filed on December 9, 1999. In other words, the two applications were co-pending. With the present amendment, Applicant's specification has been amended to reflect a claim of priority from the Himes et al. reference. Also, a declaration that reflects the priority claim is enclosed and has been executed by both of the inventors associated with the present application. Accordingly, it is respectfully submitted that Applicant's claim of priority from the Himes et al. reference has been properly carried out.

It is therefore respectfully submitted that the Himes et al. reference should no longer be considered prior art under 35 U.S.C. 102(e) or otherwise. It is therefore submitted that Applicant's §102(e) rejection based on that reference should be withdrawn.

It is respectfully submitted that because all grounds of their rejection have been remedied as described above, claims 1-3, 6, 11, 12 and 15 are allowable in their present form. Applicant respectfully solicits allowance of these claims.

On page 4 of the Office Action, through half of page 5, the Examiner rejected claims 4, 5, 7-10 and 17 under 35 U.S.C. §103(a) as being unpatentable over Himes et al. in view of Lambert (US 5,795,162). Claim 17 is cancelled with this amendment, but claims 4, 5 and 7-10 remain pending.

As was explained above, Applicant now claims priority from the Himes et al. reference, thereby eliminating the ability to rely on that reference as prior art. Accordingly, it is

respectfully submitted that only the Lambert reference survives in the Examiner's §103 rejection.

It is respectfully submitted, therefore, that the Examiner's rejection now lacks the elements for which Himes et al. was cited in the §103 rejection. Accordingly, for at least this reason, claims 4, 5, and 7-10, which were rejected in view of Himes et al. and Lambert, should be in allowable form. Allowance of these claims is respectfully solicited.

It is respectfully pointed out that each of the dependent claims rejected in the page 4/5 rejection (claims 4, 5 and 7-10) depends on independent claim 2, and that dependent claim 15 is also dependent upon independent claim 2. Accordingly, Applicant will give some attention to dependent claim 15 at this point, during further discussion of dependent claims 4, 5 and 7-10.

Applicant respectfully submits that claims 4, 5, 7-10 and 15 are allowable over Lambert, even considering the reference independently. Each of these dependent claims depends on independent claim 2.

Independent claim 2 has been amended to specifically recite a disc drive that incorporates "a flexible circuit comprising an electrically conductive element" that is laminated to "a dielectric liquid crystal substrate". The flexible circuit is recited as being electrically connected to a transducer head that is configured to be carried proximate a surface of a spinning data storage disc.

It is respectfully pointed out that Lambert neither teaches nor suggests incorporating a flexible circuit having a dielectric liquid crystal substrate into a disc drive, as is claimed in independent claim 2. Lambert teaches a flexible circuit interconnection method that is particularly well suited for radio frequency (RF) device applications (see Lambert at column 1, lines 10-60). There is no teaching or suggestion that

the concepts described in Lambert could or should be incorporated into a disc drive application. It is possible that the concepts taught by Lambert might not be applicable in a disc drive environment, given significant spatial limitations and motion-sensitivities associated with the internal functional structures associated with disc drives.

As is described in Applicant's specification, in the context of disc drives, a flexible circuit may be utilized to provide an electrical connection between a transducer head mounted on a suspension and disc drive circuitry (page 5, lines 21-23). To obtain desirable performance characteristics of the disc drive unit, the flexible circuit should not negatively influence motion of the transducer head, which typically is utilized to read and/or write data from a disc surface or for glide testing a disc surface for imperfections (page 5, line 30 through page 6, line 2).

Applicant has discovered that incorporation of dielectric liquid crystal polymers (i.e., rather than traditional polyimide films) into flexible substrates for disc drive flexible circuits can reduce negative influences on transducer head motion. Liquid crystal polymers substrates have reduced sensitivity to temperature and humidity changes relative to polyimide substrates (see specification at page 4, lines 10-15).

For precise positioning of the transducer head, liquid crystal polymer substrates have sufficient mobility and improved resonant motion insensitivity. Dielectric liquid crystal substrates are also of benefit to disc drive applications because they are relatively inexpensive and can be thermoplastic, allowing them to be hot bonded or welded to metal electrically conductive elements (page 4, lines 15-21).

Accordingly, it is respectfully submitted that the above distinctions between the claim 2 disc drive and the teachings of Lambert signify non-obvious and patentable

improvements. Therefore, it is further submitted that claims 4, 5, 7-10 and 15 can also be distinguished from Lambert, based at least on their dependency on claim 2. With this in mind, it is therefore respectfully submitted that dependent claims 4, 5, 7-10 and 15 are patentably distinguishable from Lambert and should be allowable in their present form for this additional reason. Applicant respectfully solicits allowance of these claims.

It should be pointed out that dependent claims 3-12 and 15 have been amended with the present amendment to reflect the amendments made to independent claim 2.

In conclusion, Applicants submit that independent claims 1 and 2 are allowable over the references cited by the Examiner. It is further submitted that dependent claims 3-12 and 15, which depend on independent claim 2, are allowable as well. Reconsideration and allowance of claims 1-12 and 15 are respectfully requested.

The Director is authorized to charge any fee deficiency required by this paper or credit any overpayment to Deposit Account No. 23-1123.

Respectfully submitted,

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MARKED-UP VERSION OF REPLACEMENT PARAGRAPHS

Replacement paragraph for the paragraph beginning at Page 1, Line 3 and ending at Page 1, Line 7:

This application claims priority to U.S. provisional Patent Application Serial No. 60/116,781 to Schulz et al., entitled "Flex on Suspension (FOS) With Liquid Crystal Polymer (LCP) Dielectric," incorporated herein by reference; and to U.S. Patent Application No. 09/076,164 to Himes et al., entitled "Flex Circuit Head Interconnect With Insulating Spacer," now U.S. Patent No. 6,046,886, incorporated herein by reference.

Replacement title for Page 1, Line 1, and Page 21, Line 1:

DISC DRIVES HAVING FLEXIBLE CIRCUITS WITH LIQUID CRYSTAL POLYMER DIELECTRIC

MARKED-UP VERSION OF REPLACEMENT CLAIMS

2. (Amended) A disc drive comprising:
at least one data storage disc;
a suspension assembly that includes a transducer head
supported on an adjustable arm; and
[A]a flexible circuit comprising an electrically
conductive element and a dielectric liquid crystal
substrate laminated to the conductive element, the
flexible circuit being electrically connected to
the transducer head and the transducer head being
configured to be carried proximate a surface of a
spinning data storage disc.
3. (Amended) The [flexible circuit] disc drive of claim 2
wherein the conductive element comprises copper.
4. (Amended) The [flexible circuit] disc drive of claim 2
wherein the dielectric liquid crystal substrate has a thickness
less than about 0.001 inches.
5. (Amended) The [flexible circuit] disc drive of claim 2
wherein the dielectric liquid crystal substrate has a thickness
from about 0.0001 inches to about 0.0005 inches.
6. (Amended) The [flexible circuit] disc drive of claim 2
wherein the dielectric liquid crystal substrate comprises a
polyester.
7. (Amended) The [flexible circuit] disc drive of claim 2
wherein the dielectric liquid crystal substrate has a dielectric
constant from about 2.6 to about 3.0.

8. (Amended) The [flexible circuit] disc drive of claim 2 wherein the dielectric liquid crystal substrate has a coefficient of thermal expansion from about 15 ppm/°C to about 19 ppm/°C.

9. (Amended) The [flexible circuit] disc drive of claim 2 wherein the dielectric liquid crystal substrate has a coefficient of humidity expansion of less than about 4 ppm/% relative humidity.

10. (Amended) The [flexible circuit] disc drive of claim 2 wherein the dielectric liquid crystal substrate has an elastic modulus from about 900 kpsi to about 1300 kpsi.

11. (Amended) The [flexible circuit] disc drive of claim 2 further comprising a cover coating forming protective coating over at least a portion of the conductive element.

12. (Amended) The [flexible circuit] disc drive of claim 2 wherein the liquid crystal substrate comprises a thermoplastic.

Claim 13 has been cancelled.

Claim 14 has been cancelled.

15. (Amended) The disc drive of claim [14] 2 wherein the data storage disc comprises a magnetic disc.

Claims 16-20 have been cancelled.